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**COMPLIANCE DETERMINATION METHOD FOR REVIEW PLAN NO. 4.3  
ASSESSMENT OF COMPLIANCE WITH DESIGN CRITERIA FOR SHAFTS AND RAMPS**

**3.0 REVIEW PROCEDURES AND ACCEPTANCE CRITERIA**

**3.1 Acceptance Review**

In conducting the Acceptance Review for docketing, the staff will compare the information in the license application (LA) concerning shafts, ramps, boreholes, and their seals (SRBS) with the corresponding section of the FCRG and with the staff's resolution status of objections in the Open Item Tracking System and determine if this information meets the following criteria.

- (1) The information presented in the LA is clear, is completely documented consistent with the level of detail presented in the corresponding section of the FCRG, and the references have been provided.
- (2) The DOE either resolved, at the staff level, the NRC objections that apply to this regulatory requirement topic or provided the information requested in Section 1.6 of the FCRG for unresolved objections. Namely, the DOE has:
  - (a) identified the unresolved objections,
  - (b) explained the differences between the NRC and DOE positions that precluded resolution of each objection,
  - (c) described the attempts to achieve resolution,
  - (d) explained why resolution has not been achieved, and
  - (e) described the effects of the different positions on demonstrating compliance with 10 CFR Part 60.
- (3) Unresolved objections, individually or in combination with others, will not prevent either the reviewer from conducting a meaningful Compliance Review or the NRC from making a decision regarding construction authorization within the 3-yr statutory period.

**3.2 Compliance Reviews**

These review procedures are written so that they can be used for any SRBS systems identified by the DOE. For the designs of the SRBS, the reviewer should evaluate whether the DOE acceptably demonstrated compliance with the applicable regulations for the following systems: (1) Waste Shaft or Ramp, (2) Muck Shaft or Ramp, (3) Ventilation Intake Shafts, (4) Ventilation Exhaust Shafts, (5) Personnel and Material Shafts, (6) Decommissioning System, and (7) any other systems of the SRBS. The designs of the portals and collars are not considered here but are considered as part of the designs/analyses (e.g., engineering proofs, models, calculations, drawings, and designs/technical specifications) of surface facilities in Review Plan 4.2.

The FCRG has suggested a format for separating the regulatory requirements applicable to this Review Plan and it is anticipated that the DOE will use this format to prepare the LA. To have a more efficient review, this Review Plan follows the suggested FCRG format to the extent practicable. The applicable regulatory requirements of 10 CFR 60.21(c), listed in Section 1.0 of this Review Plan, are grouped under one review because of the general and broad application to SRBS designs.

Per 10 CFR 60.21(c)(14), the DOE shall identify structures, systems, and components (SSC) of the geologic repository, both surface and subsurface, which require research and development to confirm the adequacy of design. Also, for structures, systems, and components important to safety (SSCIS) and for the engineered and natural barriers important to waste isolation, the DOE shall provide a detailed description of the programs designed to resolve safety questions and include a schedule of when these questions will be resolved. The NRC staff should defer any focused safety reviews of those SSC so identified by the DOE until such time, as indicated by the DOE, that these safety questions have been resolved.

The review procedure for the applicable regulatory requirements of 10 CFR 60.21(c), listed in Section 1.0 of this Review Plan includes two review steps, an evaluation of the information required for the designs of the SRBS and an evaluation of the list of SSCIS for completeness. The review procedure for 10 CFR 60.130 also includes two review steps, an evaluation of the consistency of the design bases with site characterization and an evaluation of the safety features needed for the SRBS. The procedural steps for review of 10 CFR 60.111(a), 60.111(b), 60.131(a)(1-6), and 60.131(b)(1-8) are in Review Plan 4.2. The procedural steps for review of 10 CFR 60.137 are in Review Plan 4.4. Due to the anticipated design of the GROA no review is required for 10 CFR 60.131(b)(10). The procedural steps for the review of the design criteria, 10 CFR 60.131(b)(9), 60.134(a), and 60.134(b), follow a consistent three review step approach and are illustrated in the following.

- (1) The reviewer should evaluate the environmental conditions, operations, events, and scenarios for which the SRBS are designed and determine whether they are adequately described and provide enough detail to support the safety reviews of the SRBS designs/analyses.
- (2) The reviewer should evaluate the specific information and design/technical specifications of the SRBS to determine whether they are adequately described and provide enough detail to support the safety reviews of the SRBS designs.
- (3) The reviewer should select one or more specific SSC of the SRBS for focused review(s) and evaluate the designs/analyses to determine whether the selected item's designs/analyses are acceptable.

For each review procedure step, the reviewer is to prepare a summary statement as to whether or not the acceptance criteria are satisfied. These summaries form part of the bases for the evaluation finding for the regulatory requirements. If the acceptance criteria are not satisfied, the reviewer should document the deficiencies. A Key Technical Uncertainty (KTU) has been identified for 10 CFR 60.134. Relevant discussion for this KTU is given in Section 3.2.11 of this Review Plan and the review procedure steps are being developed.

**3.2.1 Safety Review of 10 CFR 60.21(c)**

This portion of the safety review addresses compliance with the applicable regulatory requirements of 10 CFR 60.21(c), listed in Section 1.0 of this Review Plan, as they relate to 10 CFR 60.111(a), 60.130, 60.131, 60.134, and 60.137. The scope of this safety review focuses on the descriptions, assessments, and analyses required in the Safety Analysis Report. This information is needed to evaluate the adequacy of the SRBS designs and, thus, is evaluated in coordination with the safety reviews conducted in Sections 3.2.2 to 3.2.11 of this Review Plan. This safety review will also be supported by the Acceptance Review of the SRBS descriptions provided in Section 4.1.2 of the LA. The adequacy of this information is evaluated in the context of compliance with the pertinent design criteria for the SRBS, evaluated in

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Sections 3.2.2 to 3.2.11 of this Review Plan.

**3.2.1.1 Review of Descriptive and Analytical Information**

The reviewer should evaluate the information provided in the Safety Analysis Report to determine whether it has enough detail to support the safety reviews of the SRBS designs. The reviewer can determine whether the applicable criteria of 10 CFR 60.21(c), listed in Section 1.0 of this Review Plan, are met only after the safety reviews in Sections 3.2.2 to 3.2.11 of this Review Plan have been completed, where specific information is reviewed in the first two steps of each safety review. The acceptance criteria are:

- (1) The descriptions are provided in enough detail to support the safety reviews of the SRBS designs and to determine compliance with the applicable regulatory requirements of 10 CFR 60.21(c).
- (2) Although Regulatory Guide 3.6, Content of Technical Specifications for Fuel Reprocessing Plants (NRC, 1973), deals with another type of facility, it contains acceptance criteria adaptable for the information review in Regulatory Positions C.1, C.2, C.3, and C.4.

**3.2.1.2 Review of the Structures, Systems, and Components Important to Safety and Waste Isolation**

Before conducting the reviews of 10 CFR 60.130, 60.131, 60.134, and 60.137, the reviewer should evaluate the lists of SSCIS and engineered and natural barriers important to waste isolation of the SRBS to determine whether the lists are complete and whether the items that require further research and development to confirm the adequacy of their designs are identified and described in enough detail to support the safety reviews of the SRBS. Acceptance criteria are that the following are assured.

- (1) The identification of the SSCIS is based on the functions of the SSC of the SRBS and the definition of important to safety given in 10 CFR 60.2.
- (2) The methodology used to determine which SSC have functions that are important to safety or waste isolation is based on a logical and well documented approach.
- (3) The descriptions of the SSC important to safety and waste isolation provide the safety/isolation functions, performance characteristics, and interactions of these SSC with other SSC, both within and external to the SRBS. These descriptions must provide that:

- (a) the margins of safety under normal environmental conditions and under conditions and events that are unlikely, yet can be reasonably expected to occur prior to permanent closure, such as those events referred to in American Nuclear Society Standard, ANSI/ANS-57.9-1984, as Design Events I, II, III, and IV (ANS, 1984) are presented in enough detail to support the safety reviews of the SRBS designs;
- (b) the designs and functions of the SSC important to safety and waste isolation are presented in enough detail to support the safety reviews of the SRBS designs; and
- (c) the necessary safety/isolation functions for each SSC are presented in terms of the functions before, during, and after personnel and mining safety related event(s) that

impact the SSC.

(4) The descriptions of the SSCIS and engineered and natural barriers important to waste isolation that require further research and development to confirm the adequacy of design are adequate and the rationale for the needed research and development is presented for each of these items.

(5) The detailed descriptions of the programs which will be used to resolve safety questions are adequate and include schedules indicating when the safety questions will be resolved.

Before starting the reviews for Sections 3.2.2 to 3.2.11 of this Review Plan, the reviewer should prepare a summary that states whether or not the SSCIS and engineered and natural barriers important to waste isolation are adequately identified and described in enough detail to proceed with the other safety reviews of the SRBS. After these other safety reviews are completed, a summary should be prepared by the reviewers that states whether or not adequate information is presented in the Safety Analysis Report to determine compliance with all the applicable regulatory requirements of 10 CFR 60.21(c), listed in Section 1.0 of this Review Plan.

**3.2.2 Safety Review of 10 CFR 60.130**

The scope of this part of the safety review encompasses two different perspectives of the SRBS designs, as expressed in 10 CFR 60.130. First, the design bases for SRBS must be consistent with results of site characterization activities. Second, if the performance objectives can only be achieved by providing safety features for a specific facility, e.g., features not specified in the design criteria of 10 CFR 60.131, 60.134, 60.137, where 10 CFR 60.132 and 60.133 do not apply to SRBS, the reviewer should evaluate whether or not these features perform their intended functions and are incorporated in the performance assessment (PA). The reviews of any safety features are expected to be focused safety reviews, similar to those in Sections 3.2.3 to 3.2.11 of this Review Plan.

**3.2.2.1 Review of Consistency of the Design Bases With Site Characterization**

The reviewer should evaluate the design bases for SRBS to determine whether they are consistent with the results of site characterization activities. The reviewer should determine whether the design bases are consistent with applicable site characterization data after the safety reviews in Sections 3.2.3 to 3.2.11 of this Review Plan have been completed. There should be interaction with the reviewers of the relevant Review Plans identified in Section 4.2.1 of this Review Plan, in assuring that the designs/analyses information is a reasonable interpretation of the data acquired during site characterization. The adequacy of the site characterization data is addressed in Sections 3.1 and 3.2 of the LARP. (Note that this may require discussions with other staff members to confirm.) DOE should identify and describe the site characterization data uncertainties and describe how these uncertainties are addressed by the SRBS designs/analyses. The acceptance criteria include, but are not limited to, the following.

(1) The site characterization data is in a form that relates directly to the needed design information (e.g., earthquake motion is expressed as a time history) and that the site data is in enough detail for the design bases.

(2) The design bases are consistent with applicable site characterization data, as determined from the safety reviews in Sections 3.2.3 to 3.2.11 of this Review Plan.

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### 3.2.2.2 Review of Additional Design Criteria

The reviewer should evaluate any additional design criteria or safety features considered to be necessary for the SRBS designs to comply with the performance objectives. The reviewer should determine whether the data and analyses used for the SRBS designs are adequate for these additional items. General acceptance criteria for safety features of the SRBS are taken from the design criteria of 10 CFR 60.133, since these design criteria should apply to the SRBS designs but cannot be directly applied due to the definition of the underground facility excluding shafts, ramps, boreholes and their seals. The general acceptance criteria include, but are not limited to, the following.

- (1) The orientation, geometry, layout, and depth of the SRBS contribute to the isolation of radionuclides.
- (2) The SRBS are designed so that the effects of credible disruptive events during the period of operations, such as flooding, fires, and explosions, will not spread through the SRBS.
- (3) The SRBS are designed with sufficient flexibility to allow adjustments where necessary to accommodate specific site environmental conditions identified through *in situ* monitoring, testing, or excavation.
- (4) The SRBS are designed to permit retrieval of waste in accordance with the performance objectives of 10 CFR 60.111.
- (5) The SRBS are designed to provide for control of water and gas intrusion, as applicable.
- (6) The SRBS are designed so that operations can be carried out safely and the retrievability option maintained.
- (7) The SRBS are designed to reduce the potential for deleterious rock movement or fracturing of overlying or surrounding rock.
- (8) The SRBS are designed to incorporate excavation methods that will limit the potential for creating a preferential pathway for groundwater to contact the waste packages or radionuclide migration to the accessible environment.
- (9) The SRBS ventilation systems are designed to:
  - (a) control the transport of radioactive particulates and gases within and releases from the underground facility in accordance with the performance objectives of 10 CFR 60.111(a);
  - (b) continue to function during normal operations and under accidents; and
  - (c) separate the ventilation of excavation and waste emplacement areas.
- (10) The SRBS are designed to meet the performance objectives, taking into account the predicted thermal and thermomechanical response of the host rock, surrounding strata, and groundwater system.

Note that for the general acceptance criteria 1-10 more specific and detailed acceptance criteria adaptable

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for the review of the SRBS designs are provided in Review Plans 4.4 and 4.5.2.

### **3.2.3 Safety Review of 10 CFR 60.111(a) and 60.131(a)(1-6)**

The review procedures and acceptance criteria to evaluate compliance with 10 CFR 60.111(a) and 60.131(a)(1-6) are applicable to the SRBS, surface facilities, and underground facility, however, the review procedures and acceptance criteria are only provided in Review Plan 4.2. Therefore, the reviewer should use the applicable acceptance criteria in Review Plan 4.2 to determine whether the SRBS designs comply with the requirements of 10 CFR 60.111(a) and 60.131(a)(1-6).

### **3.2.4 Safety Review of 10 CFR 60.111(b)**

The review procedures and acceptance criteria to evaluate compliance with 10 CFR 60.111(b) are applicable to the SRBS, surface facilities, and underground facility, however, the review procedures and acceptance criteria are provided in Review Plan 4.5.2. Therefore, the reviewer should use the applicable acceptance criteria in Review Plan 4.5.2 to determine whether the SRBS designs comply with 10 CFR 60.111(b).

### **3.2.5 Safety Review of 10 CFR 60.131(b)(1-8)**

The review procedures and acceptance criteria to evaluate compliance with 10 CFR 60.131(b)(1-8) are applicable to the SRBS, surface facilities, and underground facility, however, the review procedures and acceptance criteria are only provided in Review Plan 4.2. Therefore, the reviewer should use the applicable acceptance criteria in Review Plan 4.2 to determine whether the SRBS designs comply with 10 CFR 60.131(b)(1-8).

### **3.2.6 Safety Review of 10 CFR 60.131(b)(9)**

The scope of this part of the safety review is focused on the designs of the SRBS for preclosure compliance with applicable Mine Safety and Health Administration (MSHA) regulations (MSHA, 1994) for allowing determination of compliance with 10 CFR 60.131(b)(9), for the environmental conditions and events associated with normal operations and anticipated conditions and events, such as those events referred to in American Nuclear Society Standard, ANSI/ANS-57.9-1984, as Design Events I, II, and III (ANS, 1984).

Some of the MSHA regulations (MSHA, 1994) only apply to the shafts and ramps or surface facilities, while other MSHA regulations apply to the shafts and ramps, surface facilities, and underground facility. To determine compliance with 10 CFR 60.131(b)(9) for the surface facilities and underground facility, Review Plans 4.2 and 4.4 will refer to the review procedure and applicable acceptance criteria in this Review Plan.

#### **3.2.6.1 Review of Conditions, Operations, Events, and Scenario Descriptions**

The reviewer should evaluate the environmental conditions, operations, events, and scenarios (that are used in the designs of the SRBS to include provisions for worker protection to the extent that may be necessary to provide reasonable assurance that the SSCIS can perform their intended functions) to determine whether they are adequately described to allow determination of compliance with 10 CFR 60.131(b)(9) and the applicable regulatory requirements of 10 CFR 60.21(c), listed in Section 1.0 of this

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Review Plan. The acceptance criteria for this step include, but are not limited to, the following.

- (1) Event-trees, fault-trees, failure modes and effects analyses, human-reliability analyses, and similar methods for accident-sequence definitions are adequately described in enough detail for the designs that provide compliance with the applicable mining regulations. The mining regulations that are applicable to the designs to assure safe performance of SSCIS include, but are not limited to, those grouped by topic in Table 3.2.6-1.
- (2) Event-trees, fault-trees, failure modes and effects analyses, human-reliability analyses, and similar methods for accident-sequence definition and system modeling that represent repository environmental conditions and events that affect the designs that provide compliance with the applicable mining regulations identified in Table 3.2.6-1, are consistent with Chapters 3 and 4 of NUREG/CR-2300, PRA (Probabilistic Risk Assessment) Procedures Guide (NRC, 1983).
- (3) Design basis events and environmental conditions used as the basis for the SRBS designs to provide compliance with the applicable mining regulations identified in Table 3.2.6-1, are consistent with applicable site characterization results.
- (4) Operations (e.g., routine and emergency operations, testing, and maintenance) are adequately described in enough detail so as to allow evaluation of the SRBS designs to provide compliance with the applicable mining regulations identified in Table 3.2.6-1.

TABLE 3.2.6-1 Applicable Mining Regulations

TOPIC	REGULATORY CITATION
<b>General Personnel Protection:</b>	
<b>Respirators and Gas Masks, Approval by MSHA Sufficient</b>	<b>30 CFR 11.2, 11.2-1, and 11.30</b>
<b>Electric Cap Lamps, Approval by MSHA Sufficient</b>	<b>30 CFR 19.1-13</b>
<b>Electric Mine Lamps Other Than Standard Cap Lamps, Approval by MSHA Sufficient</b>	<b>30 CFR 20.0-14</b>
<b>Traffic Safety for Operation of Self-Propelled Mobile Equipment</b>	<b>30 CFR 57.9100-9104 and 57.9160</b>
<b>Traffic Safety for Transportation of Persons and Materials</b>	<b>30 CFR 57.9200-9261</b>
<b>Safety Devices; Provisions and Procedures for Roadways and Devices; and Procedures for Safety of Personnel Along Roadways, Railroads, and Material Transfer Sites</b>	<b>30 CFR 57.9300-9362</b>
<b>Travelways and Escapeways</b>	<b>30 CFR 57.11001-11017</b>

TOPIC	REGULATORY CITATION
Travelways—Surface Only	30 CFR 57.11025–11027
Travelways—SRBS and Underground Only	30 CFR 57.11036–11041
Escapeways—SRBS and Underground Only	30 CFR 57.11050–11059
Personal Protection Equipment, e.g., Hard Hats, Footwear, Safety Belts, Eye Glasses, etc.	30 CFR 57.15001–15031
Safety Programs	30 CFR 57.18002–18014
Safety Programs—Surface Only	30 CFR 57.18020
Safety Programs—SRBS and Underground Only	30 CFR 57.18025 and 57.18028
Intoxicating Beverages and Narcotics	30 CFR 57.20001
Potable Water Supply	30 CFR 57.20002
Housekeeping	30 CFR 57.20003
Prohibited Areas for Food and Beverages	30 CFR 57.20014
<b>Explosives:</b>	
Explosives and Sheathed Explosive Units, Approval by MSHA Sufficient	30 CFR 15.6–11
Storage of Explosives	30 CFR 57.6001–6012
Storage of Explosives—Surface Only	30 CFR 57.6020
Storage of Explosives—SRBS and Underground Only	30 CFR 57.6027–6030
Transportation of Explosives	30 CFR 57.6040–6057
Transportation of Explosives—Surface Only	30 CFR 57.6065
Transportation of Explosives—SRBS and Underground Only	30 CFR 57.6075–6077
General Use of Explosives	30 CFR 57.6090–6168
Use of Explosives—SRBS and Underground Only	30 CFR 57.6175–6182
Sensitized Ammonium Nitrate Blasting Agents	30 CFR 57.6193–6200
Sensitized Ammonium Nitrate Blasting Agents—SRBS and Underground Only	30 CFR 57.6220



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TOPIC	REGULATORY CITATION
Miscellaneous Precautions for Explosives, e.g., Smoking and Open-Flame Restrictions	30 CFR 57.6250
Blasting in Hazardous Areas—SRBS and Underground Only	30 CFR 57.20031
Equipment and Locomotion:	
Electric Motor-Driven Mine Equipment and Accessories, Approval by MSHA Sufficient	30 CFR 18.2 and 18.11-13
Diesel Mine Locomotives, Approval by MSHA Sufficient	30 CFR 31.1, 31.2, 31.3(d) and 31.6(c)
Mobile Diesel-Powered Equipment for Non-coal Mines, Approval by MSHA Sufficient	30 CFR 32.1, 32.2, 32.3(d) and 32.6(c)
Mobile Diesel-Powered Transportation Equipment, Approval by MSHA Sufficient	30 CFR 36.2, 36.4, 36.10 and 36.11
Compressed Air, Boilers, and Pressure Vessels	30 CFR 57.13001-13030
Machinery and Equipment Safety Devices and Maintenance Requirements and Design; Installation and Maintenance of Safety Devices Installed on Equipment	30 CFR 57.14100-14162
Safety Practices and Operational Procedures for Equipment	30 CFR 57.14200-14219
Telephone and Signaling Devices:	
Methane Monitoring Systems, Approval by MSHA Sufficient	30 CFR 27.2, 27.5, 27.7 and 27.11
Telephone and Signaling Devices, Approval by MSHA Sufficient	30 CFR 23.2, 23.11, 23.12 and 23.14
Signaling Procedures	30 CFR 57.19090-19096
Two-way Communications—SRBS and Underground Only	30 CFR 57.20032
Ground Control:	
Scaling and Support	30 CFR 57.3200-3203
Scaling and Support—SRBS and Underground Only	30 CFR 57.3400-3401
Precautions	30 CFR 57.3400 and 57.3401

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TOPIC	REGULATORY CITATION
Precautions—Surface Only	30 CFR 57.3430
Precautions—SRBS and Underground Only	30 CFR 57.3460 and 57.3461
Retaining Dams	30 CFR 57.20010
Unattended Mine Openings	30 CFR 57.20020
Abandoned Mine Openings	30 CFR 57.20021
<b>Fire Protection:</b>	
Electrical Fires	30 CFR 57.4011 and 57.4057
Prohibitions, Precautions, and Housekeeping for Fire Prevention	30 CFR 57.4100–4161
Fire-Fighting Equipment	30 CFR 57.4200–4263
Fire-Fighting Procedures, Alarms, and Drills	30 CFR 57.4330–4363
Flammable and Combustible Liquids and Gases	30 CFR 57.4400–4463
Installation, Construction, and Maintenance for Fire Prevention	30 CFR 57.4500–4561
Welding, Cutting, and Compressed Gases for Fire Prevention	30 CFR 57.4600–4660
Ventilation Control Measures for Fire Prevention	30 CFR 57.4760 and 57.4761; must also satisfy 10 CFR 60.131(a), 60.131(b)(3), 60.131(b)(4)(i), 60.132(b) and 60.133(g)
Explosive Use in Presence of Methane	30 CFR 57.22601–22608
Methane Monitoring and Control Equipment	30 CFR 57.22003 and 57.22301–22315
Mine Categorization with Respect to Methane Presence	30 CFR 57.22003
Smoking and Open Flames for Fire Prevention	30 CFR 57.22101–22105
<b>Air Quality and Ventilation:</b>	
Air Quality	30 CFR 57.5001–5006
Air Quality—Surface Only	30 CFR 57.5010
Air Quality—SRBS and Underground Only	30 CFR 57.5015 and 57.5016
Radon—SRBS and Underground Only	30 CFR 57.5037–5046
Noise Exposure Limits	30 CFR 57.5050

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TOPIC	REGULATORY CITATION
Ventilation	30 CFR 57.8518 and 57.8519; must also satisfy 10 CFR 60.131(a), 60.131(b)(4)(i), 60.132(b), and 60.133(g)
Ventilation—SRBS and Underground Only	30 CFR 57.8520–8535; must also satisfy 10 CFR 60.131(a), 60.131(b)(4)(i), 60.132(b), and 60.133(g)
Ventilation for Methane Presence	30 CFR 57.22201–22241; must also satisfy 10 CFR 60.131(a), 60.131(b)(4)(i), 60.132(b), and 60.133(g)
<b>Personnel Hoists:</b>	
Aerial Tramways	30 CFR 57.10001–10010
Hoists—SRBS Only	30 CFR 57.19001–19018
Wire Ropes—SRBS Only	30 CFR 57.19019–19030
Headframes and Sheaves—SRBS Only	30 CFR 57.19035–19038
Conveyances—SRBS Only	30 CFR 57.19045–19054
Hoisting Procedures—SRBS Only	30 CFR 57.19055–19083
Shaft Systems, Equipment, and Procedures—SRBS Only	30 CFR 57.19100–19111
Inspection and Maintenance: Equipment and Procedures for Inspection and Maintenance of Personnel Hoists—SRBS Only	30 CFR 57.19120–19135
<b>Electrical and Illumination:</b>	
Electricity	30 CFR 57.12001–12053
Electricity—Surface Only	30 CFR 57.12065–12071
Electricity—SRBS and Underground Only	30 CFR 57.12080–12088
Illumination	30 CFR 57.17001 and 57.17010
Illumination in the Presence of Methane	30 CFR 57.22501
<b>Other Provisions:</b>	
Materials Storage and Handling	30 CFR 57.16001–16017
Carbon Tetrachloride Prohibited	30 CFR 57.20005
Barricades and Warning Signs	30 CFR 57.20011

TOPIC	REGULATORY CITATION
Labeling of Toxic Materials	30 CFR 57.20012
Mine Categorization for Methane	30 CFR 57.22003-2200

**3.2.6.2 Review of Designs, Design Bases, and Design/Technical Specifications**

The reviewer should evaluate the SRBS designs, design bases, and design/technical specifications to determine whether they are adequately described to allow determination of compliance with 10 CFR 60.131(b)(9) (related to applicable mining regulations identified in Table 3.2.6-1, for worker protection) and the applicable regulatory requirements of 10 CFR 60.21(c), listed in Section 1.0 of this Review Plan. Specific design provisions for worker protection are set out by MSHA in Title 30 of the Code of Federal Regulations (MSHA, 1994) and the applicable regulatory citations are grouped under the following topics: (1) Personnel Protection, (2) Explosives, (3) Equipment and Locomotion, (4) Telephone and Signaling Devices, (5) Ground Control, (6) Fire Protection, (7) Air Quality and Ventilation, (8) Personnel Hoists, (9) Electrical and Illumination Systems, and (10) Other Mining Safety Provisions. The acceptance criteria are that the design related descriptions have incorporated, but are not limited to, the following items.

- (1) The design/technical specifications and the SSCIS that are impacted by the SSC that must meet the applicable mining regulations are adequately described in enough detail and include layout drawings related to the applicable mining regulations identified in Table 3.2.6-1.
- (2) The SSC design bases, criteria, plans, loads, and capacities are adequately described in enough detail.
- (3) The interconnections among, redundancies of, and locations of the SSC that impact the safe performance of SSCIS are adequately described in enough detail.
- (4) The applicability of the mining regulations related to the SSC designs for safe performance of SSCIS are provided and adequately explained. The mining regulations that are applicable to the designs for safe performance of SSCIS include, but are not limited to, those grouped by topic in Table 3.2.6-1.

**3.2.6.3 Focused Safety Review**

One or more SSC and applicable mining regulations identified in Table 3.2.6-1 should be selected for focused safety review(s). The number and types of SSC and applicable mining regulations selected for review should be sufficiently representative to support an evaluation finding for the acceptability of the designs of the SSC.

The reviewer should evaluate the selected SSC designs/analyses to determine whether the criteria of 10 CFR 60.131(b)(9) are met. The SSC designs/analyses are to assure compliance with the regulations cited in Table 3.2.6-1, as a minimum. The acceptance criteria are the incorporation of applicable mining regulations cited in Table 3.2.6-1 in the designs/analyses. For safety devices that have been approved by the MSHA (as indicated by Approval by MSHA Sufficient in Table 3.2.6-1), the acceptance criterion is considered to be met, if there is a statement in the LA that only such MSHA-approved safety devices will be used.

### 3.2.7 Safety Review of 10 CFR 60.131(b)(10)

The scope of 10 CFR 60.131(b)(10) is the design of shaft conveyances (shaft hoists) used for waste handling. The NRC staff indicated that 10 CFR 60.131(b)(10) does not address waste transfer methods (such as vehicles in ramps or in the underground facility) other than shaft hoists (NRC, 1991). Waste transfer methods, other than shaft hoists, are addressed in a number of regulations relevant to the design features of the repository. For example, protection against dynamic effects of equipment failure [10 CFR 60.131(b)(2)], instrumentation and control systems [10 CFR 60.131(b)(8)], and the design criteria of 10 CFR 60.130 all address the safe design of waste transfer methods, other than shaft hoists. Since the DOE intends to move waste to the underground facility by vehicles and not use shaft hoists, this regulatory requirement does not apply. The design features relevant to waste movement and emplacement are reviewed in other Review Plans or in another section of this Review Plan, as indicated in Table 3.2.7-1.

TABLE 3.2.7-1 Design Features and Regulations for Movement, Transfer, and Emplacement of Waste

Design Feature/Regulatory Citation	Review Plan
Safe Handling of Wastes/10 CFR 60.132(a)	4.2
Carry Out Operations Safely/10 CFR 60.133(e)(1)	4.4
Protection Against Dynamic Effects of Equipment Failure/10 CFR 60.131(b)(2)	4.2
Instrumentation and Control Systems/10 CFR 60.131(b)(8)	4.2
Waste Package Design for Handling/10 CFR 60.135(b)(3)	5.2
Safety Features/10 CFR 60.130	4.3, Section 3.2.2

As noted in NUREG/CR-5804, the criteria covered by the alternate Review Plans in Table 3.2.7-1 primarily address preclosure safety and do not address protection of the waste packages to prevent adversely affecting containment by the mode of transfer (Hageman and Chowdhury, 1992). Since the intent of the language in 10 CFR 60.131(b)(10) is to protect the waste during handling, a minor rulemaking has been suggested in NUREG/CR-5804 so that waste conveyances and transfer methods, other than shaft hoists, would be included. Should the NRC choose to adopt the suggested rulemaking, this Review Plan will be appropriately modified.

### 3.2.8 Safety Review of 10 CFR 60.134(a)

The scope of this part of the safety review is focused on the designs of each of the appropriate individual postclosure sealing systems of the SRBS and particularly how the designs prevent pathways that would compromise the ability to meet the postclosure performance objectives, described in 10 CFR 60.112. Conclusions regarding the role of seals in meeting the postclosure performance objectives will be made based upon consultations among the Performance Assessment, Repository Design, Construction, and Operations (RDCO), and Engineered Barrier Systems (EBS) staffs. The acceptance criterion is that the designs proposed for the seals for shafts, ramps, and boreholes are included in the postclosure performance assessment.

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### 3.2.9 Safety Review of 10 CFR 60.134(b)

The scope of this part of the safety review is focused on the materials selection and placement methods specified for each of the appropriate individual systems or components of the seals and how these materials and placement methods will reduce, to the extent practicable, the potential for creating preferential pathways for groundwater and the potential for radionuclide migration through existing pathways. The conclusions regarding the role of seals in meeting the postclosure performance objectives will be made based upon consultations with the PA and EBS staff. If the acceptance criteria are not satisfied, the reviewer should document the deficiencies.

Staff guidance regarding seal material selection and placement methods in an unsaturated medium is discussed in detail in Technical Position on Postclosure Seals, Barriers, and Drainage System in an Unsaturated Medium, NUREG-1373 (Gupta and Buckley, 1989), and is the primary basis for the safety review of 10 CFR 60.134(a). In addition, studies have been funded by the NRC to assess the hydrologic properties and effectiveness of borehole plugs composed of, for example, bentonite/crushed rock (e.g., Ouyang and Daemen, 1992; Akgun and Daemen, 1990; Sharpe and Daemen, 1991; Greer and Daemen, 1991; Ran and Daemen, 1991; Crouthammel and Daemen, 1991; Fuenkajorn and Daemen, 1991; and Adisoma and Daemen, 1988). These documents and studies provide a basis for conducting a safety review of the DOE sealing program to ensure compliance with 10 CFR 60.134(a). The KTU for seals of shafts, ramps, and boreholes is discussed in Section 3.2.11 of this Review Plan.

#### 3.2.9.1 Review of Conditions, Operations, Events, and Scenario Descriptions

The reviewer should evaluate the environmental conditions, operations, events, and scenarios that impact seal material selections and placement methods to determine whether they are adequately described to allow determination of compliance with 10 CFR 60.134(b) and the applicable regulatory requirements of 10 CFR 60.21(c), listed in Section 1.0 of this Review Plan. These may include such items as: (1) sources and values of gas and liquid pressure differentials used in assessing seal performance; (2) expected performance of the seals for the postclosure period; (3) heat-, chemistry-, and time-dependent properties of the seal materials and surrounding rock that may change with time; (4) sources and characteristics of dynamic loads that may affect the bonding and performance of the seals; and (5) the *in situ* stresses in the rock surrounding the seals. The acceptance criteria include, but are not limited to, the following.

- (1) Event-trees, fault-trees, failure modes and effects analyses, human-reliability analyses, and similar methods for event/sequence definitions that affect seal material selections and placement methods are adequately described in enough detail.
- (2) Event-trees, fault-trees, failure modes and effects analyses, human-reliability analyses, and similar methods for event-sequence definition and system modeling that represent repository environmental conditions and events that affect seal material selections and placement methods are consistent with Chapters 3 and 4 of NUREG/CR-2300, PRA Procedures Guide (NRC, 1983).
- (3) Event-trees, fault-trees, failure modes and effects analyses, human-reliability analyses, and similar methods for event-sequence definitions used as the basis for seal material selections and placement methods are consistent with applicable site characterization results.
- (4) Operations (e.g., routine and emergency operations, testing, and maintenance) are adequately

described in enough detail so as to allow evaluation of the SRBS designs to provide compliance with the regulation.

**3.2.9.2 Review of Seal Material Selections, Placement Methods Descriptions, and Design/Technical Specifications**

The reviewer should evaluate the adequacy of the seal material selections and placement methods descriptions and design/technical specifications needed to allow determination of compliance with 10 CFR 60.134(b) and the applicable regulatory requirements of 10 CFR 60.21(c), listed in Section 1.0 of this Review Plan. These may include such items as materials planned for the seals and placement and construction methods for the seals. The acceptance criteria include, but are not limited to, the following.

- (1) The design/technical specifications for seal material selections and placement methods are adequately described in enough detail and include layout drawings.
- (2) The design bases, criteria, plans, loads, and capacities and the descriptions for the seal material selections and placement methods are consistent with applicable standards.
- (3) The performance requirements relevant to seal material selections and placement methods are translated into design bases, design/technical specifications, drawings, procedures, and instructions.
- (4) The means used to determine the surface and subsurface locations, based upon seal material selections and placement methods, of each shaft, ramp, and borehole, so as to limit the potential infiltration of surface water through and around the shaft, ramp, and borehole (i.e., methods used to determine that shaft and ramp portals and borehole collars are located above the maximum probable flood level) are adequately described in enough detail.
- (5) The seal placement methods and construction controls used to limit the lateral extent and degree of damage to the rock mass surrounding the SRBS are adequately described in enough detail.
- (6) The seal material selections and placement methods for drainage systems used to limit inflow into the waste emplacement area of the geologic repository and to limit the possibility for the water to contact the waste package are adequately described in enough detail.
- (7) The seal material selections and placement methods for shaft and/or ramp liners are adequately described in enough detail.
- (8) The impacts of shaft and ramp liners and removal of the liners on postclosure seal performance are adequately described in enough detail.
- (9) The possible consequences of the seal material selections and placement methods for shafts, ramps, and boreholes that may make the seals become ineffective during the period following permanent closure are adequately described in enough detail.
- (10) The seal material selections and placement methods that cause the seals to avoid compromising the ability to isolate waste following permanent closure are adequately described in enough detail.
- (11) If the shafts, ramps, and boreholes will not be sealed, the supporting rationale and analyses are

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adequately described in enough detail. This includes descriptions of the material selections and placement methods for filling shafts, ramps, borehole openings to minimize their becoming potential pathways for water infiltration or gaseous releases and that the performance objectives can be met without sealing.

**3.2.9.3 Focused Safety Review of Designs/Analyses for Seal Material Selections and Placement Methods**

One or more of the seal material selections and placement methods should be chosen for focused safety review(s). The number and types of seal materials, placement methods, and the applicable environmental conditions and events that affect these items selected for review should be sufficiently representative to support an evaluation finding for the acceptability of the seal materials and placement methods selected for the shafts, ramps, and boreholes.

The reviewer should evaluate these seal material selections and placement methods to determine whether 10 CFR 60.134(b) is met. This regulation is a subsystem design criterion which provides confidence that the performance objective for isolation of 10 CFR 60.112 (see Review Plan 6.1, Assessment of Compliance with the Requirement for Cumulative Releases of Radioactive Materials) will be met. The following acceptance criteria are identified from (1) NRC Regulations, (2) NRC Regulatory Guides, (3) NRC and Industry Codes and Standards, (4) NRC Technical Positions, or (5) other documents adaptable to the designs/analyses for the SRBS.

- (1) Seal material selections and placement methods take into account and address the particular excavation and drilling techniques used in constructing the shafts, ramps, and boreholes.
- (2) Thermomechanical effects on both sealing materials and the host rock are addressed in the designs for the seals.
- (3) The results of the seal material selections and placement methods testing are documented and addressed by the DOE.
- (4) For the alternative seal materials and placement methods, the bases for rejection or acceptance of each alternative are adequately described in enough detail.

**3.2.10 Safety Review of 10 CFR 60.137**

The review procedure and acceptance criteria to evaluate compliance with 10 CFR 60.137 are applicable to the SRBS, surface facilities, and underground facility, however, the review procedures and acceptance criteria are only provided in Review Plan 4.4. Therefore, the reviewer should use Review Plan 4.4 to determine whether the SRBS designs comply with 10 CFR 60.137.

**3.2.11 Detailed Safety Review Supported by Analyses for 10 CFR 60.134 for Predicting Long-term Performance of Seals for Shafts, Ramps, and Boreholes**

In addition to the safety reviews in Sections 3.2.8 and 3.2.9, the staff should perform a separate detailed safety review supported by analyses in relation to the KTU concerned with assessing the long-term performance of seals for shafts, ramps, and boreholes and their impact on meeting the performance objectives, described in 10 CFR 60.112. The bases for the KTU are described in Section 2.2.2 of this Review Plan. Note that the placement methods and seal materials behavior for long-term performance



of seals are not clearly understood at this time, thus this review procedure step will likely be revised as new information and knowledge are obtained.

The staff should expend special effort on evaluation of the DOE approach to long-term data extrapolation and modeling of sealing performance based on studies conducted up to the period of LA submittal and those planned to continue throughout the repository operational period, which includes performance confirmation. During this detailed safety review, the staff may review selected portions of the data, techniques used to develop the data, and the interpretations drawn from the data. The exact models that will be used in this evaluation are yet to be determined, but may include models developed from the NRC research programs (e.g., ABAQUS or TPA). As more information becomes available, from research for example, the acceptance criteria will be made more specific.

Several aspects of the seals contribute to the KTU and each may require further research, modeling analyses, and/or data application analyses to reduce the uncertainty to an acceptable level and to further quantify the acceptance criteria for long-term seal performance evaluation. The primary technical aspects of this KTU include, but are not limited to, the following.

(1) For long-term seal material stability, the reviewer should evaluate whether the DOE adequately addresses the thermal-mechanical-hydrological-chemical (TMHC) compatibility of the selected seal materials with the host rock to be effective in preventing the shafts, ramps, and boreholes from becoming preferential pathways. A potential acceptance criterion is that the techniques for modeling and/or long-term extrapolation of short-term data are adequate for determining the TMHC stability of the selected seal materials. The TMHC instability may include for example: (i) Portland Cement may not be acceptable because it contains noncrystalline phases that evolve with time, changing the mineralogy of the material; (ii) clays and cementitious materials may not be acceptable, because they can undergo volume changes related to water content changes that lead to cracking of the material and/or debonding from the surrounding rock; and (iii) heat affects the products and rates of the chemical processes and the magnitudes of the mechanical responses of the materials.

(2) For seal placement methods, the reviewer should evaluate whether the DOE adequately addresses the compatibility of the selected seal placement methods in the host rock to be effective in preventing the shafts, ramps, and boreholes from becoming preferential pathways and affecting long-term performance. This uncertainty is particularly true for the borehole seals in which placement will probably be under conditions nonconducive to direct observation and measurement during placement. A potential acceptance criterion is that analyses of the seal placement methods must demonstrate that the methods do not adversely affect the performance of the seals. For example, the hydraulic conductivity of cement grout borehole seals installed under submerged conditions is several orders of magnitude larger than that of typical cement grout seals installed and tested under optimum laboratory conditions (Greer and Daemen, 1991).

(3) For sealing fractures and voids, the reviewer should evaluate the effectiveness of the seal materials selected for penetration into the fractures and voids within the rock mass. A potential acceptance criterion is that the selected seal materials will adequately penetrate the rock mass, including large and small cracks and voids, to the necessary depth such that the permeability and hydraulic conductivity can be lowered to an acceptable value.

(4) For potential changes of long-term permeability and sorption of seals, the reviewer should evaluate whether the seals remain effective. Potential acceptance criteria are:

- (a) The techniques for modeling and/or long-term extrapolation of short-term data are adequate for determining the changes in seal permeability due to long-term gas and liquid pressure differentials that are likely to exist across the seals.
- (b) The techniques for modeling and/or long-term extrapolation of short-term data are adequate for determining the long-term sorption behavior of the seals, if the seals are expected to sorb radionuclides. For example, some seal-material surfaces may sorb radionuclides for a longer time before becoming saturated, which can make that seal material more acceptable for long-term performance.

(5) For long-term thermal and mechanical interactions between the seal and surrounding rock, the reviewer should evaluate whether the DOE has accounted for the compatibility of the selected seal materials coupled with the host rock to be effective in preventing the shafts, ramps, and boreholes from becoming preferential pathways and affecting the long-term performance. For example, first, the heating and then cooling of a seal with time could produce an expansion and contraction of a material that could lead to cracking, increased permeability, and adverse affects on seal performance. In addition, a loss of cohesion, could produce settlement or movement relative to the rock. This movement could cause increased permeability which adversely affects the performance of the seal. Second, the response of the rock to heating and then cooling can be different from the response of the seal materials, which could lead to differential expansion and contraction. These differential movements should not cause debonding of the interface between the rock and the seal that lead to increased permeability that adversely affects seal performance. A potential acceptance criterion is that the techniques for modeling and/or long-term extrapolation of short-term data are adequate for determining the long-term heat loads and thermal expansion/contraction effects in the seal materials and the interactions between the seal materials and the surrounding rock.

(6) For the effects of repeated dynamic loads from earthquakes or underground nuclear explosions on seal performance, the reviewer should evaluate whether the seals remain effective. A potential acceptance criterion is that the techniques for modeling and/or long-term extrapolation of short-term data are adequate for determining the response of the seals and its interactions with the surrounding rock due to repetitive loads. For example: (i) the repeated loads should not cause cumulative slip on joints that cause rock blocks to crush or pull away from a seal, allowing preferential pathways that could adversely affect seals performance, (ii) the repetitive loading should not cause fatigue in the seal material that leads to cracking or a loss of strength, causing a settlement that ultimately results in an increase in hydraulic conductivity that could adversely affect seal performance, (iii) the repeated loads should not cause differing responses in the seals and the surrounding rock such that the bond between them is broken, leading to increased permeability that could adversely affect seal performance. The reviewer should conduct an independent analysis using available models (e.g., ABAQUS) and seal design information provided by DOE as well as representative seismic loadings to assess whether the above criteria are met. In doing so, the reviewer should compute measures such as liquid fluxes to the repository horizon or gas fluxes to the ground surface through the sealed regions, which could then be provided as input to the performance assessment for determining whether the performance objective of 10 CFR 60.112 is met.

### **3.3 Rationale for Review Procedures and Acceptance Criteria**

#### **3.3.1 Rationale for Safety Review of 10 CFR 60.21(c)**

This safety review addresses descriptive and analytical information needed for compliance with the

applicable regulatory requirements of 10 CFR 60.21(c), listed in Section 1.0 of this Review Plan, as they relate to 10 CFR 60.111(a), 60.130, 60.131(a)(1-6), 60.131(b)(1-10), 60.134, and 60.137. The rationale for this safety review is that the information is an integral part of the safety reviews of the SRBS designs evaluated in Sections 3.2.2 to 3.2.11 of this Review Plan and that the information must be provided in enough detail to support the safety reviews of the SRBS designs. Also, the rationale for this safety review is that the information must provide an acceptable list of SSCIS and engineered and natural barriers important to waste isolation for the SRBS.

### **3.3.2 Rationale for Safety Review of 10 CFR 60.130**

The rationale for this safety review is that any safety features, not addressed by 10 CFR 60.131 and 60.134 (note that 10 CFR 60.132 and 60.133 do not apply to SRBS), of the SRBS must be identified and that the reviewers should assure that the design bases are adequate and confirm that these safety features have been incorporated into demonstrating that the performance objectives are met. Also, the design bases for the SRBS must be consistent with the results of site characterization activities.

### **3.3.3 Rationale for Safety Review of 10 CFR 60.111(a) and 60.131(a)(1-6)**

See Review Plan 4.2.

### **3.3.4 Rationale for Safety Review of 10 CFR 60.111(b)**

See Review Plan 4.5.2.

### **3.3.5 Rationale for Safety Review of 10 CFR 60.131(b)(1-8)**

See Review Plan 4.2.

### **3.3.6 Rationale for Safety Review of 10 CFR 60.131(b)(9)**

The rationale for the safety review of the designs/analyses of the SRBS to allow determination of compliance with 10 CFR 60.131(b)(9) is that it is a detailed review of the descriptive material and a representative sampling for the designs/analyses. The acceptance criteria come from applicable regulatory requirements (e.g., those of 30 CFR Part 57), which may reference existing industry accepted standards or guidance for similar facility systems and functions. The acceptance criteria are adaptable to the designs and operations of the SRBS because fundamental principles for compliance with mining regulations are not facility-dependent. The acceptance criteria may need to be flexibly applied to the facility's specific designs and operations because a wide variety of designs and operations can be used to meet the applicable acceptance criteria.

### **3.3.7 Rationale for Safety Review of 10 CFR 60.131(b)(10)**

The rationale for not including a compliance review procedure for evaluating the design of the SRBS to allow determination of compliance with 10 CFR 60.131(b)(10) is that the current DOE designs for the facility do not contain shaft conveyances (shaft hoists) used in radioactive waste handling, but instead will use transport vehicles.

**3.3.8 Rationale for Safety Review of 10 CFR 60.134(a)**

The rationale for this safety review is that the design criteria for the individual sealing systems should reduce, to the extent practicable, the potential for creating preferential pathways for groundwater and the potential for radionuclide migration through existing pathways, and are based upon the existing NRC studies and research. The acceptance criteria are based on those items logically linked to meeting 10 CFR 60.134(a), as clarified by the documents referenced in Section 3.2.8 of this Review Plan.

**3.3.9 Rationale for Safety Review of 10 CFR 60.134(b)**

The rationale for this safety review is that the selection of seal materials and placement methods for the individual seal systems or components should reduce, to the extent practicable, the potential for creating preferential pathways for groundwater and the potential for radionuclide migration through existing pathways, and are based upon the existing NRC studies and research. The acceptance criteria are based on those items logically linked to meeting 10 CFR 60.134(b), as clarified by the documents referenced in Section 3.2.9 of this Review Plan.

**3.3.10 Rationale for Safety Review of 10 CFR 60.137**

See Review Plan 4.4.

**3.3.11 Rationale for Detailed Safety Review Supported by Analyses of 10 CFR 60.134 for Predicting Long-term Performance of Seals for Shafts, Ramps, and Boreholes**

In addition to the safety review of information provided by the DOE, as discussed in Sections 3.2.8 and 3.2.9, the staff should perform a separate detailed safety review supported by analyses in relation to the KTU concerned with assessing the long-term performance of seals for shafts, ramps, and boreholes and their impact on meeting the performance objectives. There is a lack of experience with (i) the long-term behavior of seals, even in the absence of the complicating factor of the heat generated by the waste; (ii) coupled TMHC processes that affect the seals, surrounding rock, and performance of the seals; and (iii) repetitive seismic loads, over a long period of time, affecting the bonding of the seal to the rock to create preferential pathways. This detailed safety review will consider these and other aspects of the KTU regarding the performance of seals and other aspects of the designs and performance of seals for which it is not possible to perform a safety review based on handbooks, standard formulas, or standard and routine calculations. Because of this KTU, it is not possible at this time to provide detailed and specific acceptance criteria. As more information becomes available, from research for example, the acceptance criteria will be made more specific.

#### 4.0 IMPLEMENTATION

##### 4.1 Review Responsibilities

Lead:	NMSS-DWM-ENGB-GGES
Support:	NMSS-DWM-PAHB-HTS NMSS-DWM-PAHB-PAHPS NMSS-DWM-ENGB-EMS NMSS-DWM-HLUR-HQAS

##### 4.2 Interfaces

###### 4.2.1 Input Information

Information derived from activities related to other Review Plans will provide input important to this Review Plan. A list of Review Plans for which this interface may be anticipated is presented in the following table. The degree of applicability of each of these Review Plans to provide input to this Review Plan will depend upon how the DOE organizes the information in the LARP and how it cross-references this information.

Input Information	Review Plan No., And Information Needed For This Review
General Description of the Facility	1.1, design related descriptive information
Schedules	1.3, schedules for planned research and development, seal placement, and seal material selection
Site Characterization Program Review	1.6, site characterization data needed for SRBS designs
Statement of Compliance with the Performance Objectives of 10 CFR Part 60 and Summary of PA Results	1.7, compliance with the performance objectives related to seals of shafts and boreholes
Requirements for Further Technical Information	2.4, research and development needed to provide the further technical information
Radioactive Material	2.5, see Review Plan 4.2
License Specifications	2.6, design/technical specifications for the SRBS
Description of Individual System and Characteristics of the Site	3.1.1-3.1.5, site characterization data needed for SRBS designs

Input Information	Review Plan No., And Information Needed For This Review
Favorable and Potentially Adverse Conditions	3.2.1-3.2.5, site characterization data needed for SRBS designs
Description of the Structures, Systems, and Components of the SRBS	4.1.2, description of the SRBS structures, systems, and components
Assessment of Compliance with Design Criteria for Surface Facilities	4.2, interfaces with the SRBS designs
Assessment of Compliance with Design Criteria for the Underground Facility	4.4, interfaces with the SRBS designs
Assessment of Integrated SRBS Compliance with the Performance Objectives: Retrieval of Waste	4.5.2, interface of retrieval with the SRBS designs
Conduct of Repository Operations	7.1-7.10, interfaces with the SRBS designs
Performance Confirmation Program	8.1-8.6, see Review Plan 4.4
Quality Assurance	10.1-10.2, interfaces with the SRBS designs that are important to safety and isolation
Emergency Planning	11.0, interfaces with the SRBS designs and the mining regulations

**4.2.2 Output Information**

This Review Plan will provide information necessary for the review of other sections of the LA. The Review Plans that this review will most likely provide outputs to, include the following.

Output Information	Review Plan No.
Assessment of Preventing Water from Contacting the EBS	5.4
Assessment of Compliance With the Requirement for Cumulative Releases of Radioactive Materials	6.1

**5.0 EXAMPLE EVALUATION FINDINGS**

**5.1 Finding for Acceptance Review**

The NRC staff finds that the information presented by the DOE on the design of SRBS is acceptable (not acceptable) for docketing and compliance review.

**5.2 Findings for Compliance Reviews**

**5.2.1 Finding for 10 CFR 60.21(c)**

The NRC staff finds the information for descriptions, assessments, and analyses is (is not) adequate, and there is (is not) reasonable assurance the applicable regulatory requirements of 10 CFR 60.21(c), listed in Section 1.0 of this Review Plan, will be met for the SRBS.

**5.2.2 Finding for 10 CFR 60.130**

The NRC staff finds that the design of the SRBS to provide such safety features in a specific facility needed to achieve the performance objectives is (is not) adequate, and that the design bases are (are not) consistent with the results of site characterization activities, and that there is (is not) reasonable assurance that 10 CFR 60.130 will be met for the SSC of the SRBS used to meet the performance objectives.

**5.2.3 Finding for 10 CFR 60.111(a) and 60.131(a)(1-6)**

See Review Plan 4.2.

**5.2.4 Finding for 10 CFR 60.111(b)**

See Review Plan 4.5.2.

**5.2.5 Finding for 10 CFR 60.131(b)(1-8)**

See Review Plan 4.2.

**5.2.6 Finding for 10 CFR 60.131(b)(9)**

The NRC staff finds that it has (has not) been acceptably demonstrated that the design of the SRBS is in compliance with mining regulations related to assuring continued functioning of SSCIS, and that there is (is not) reasonable assurance that 10 CFR 60.131(b)(9) will be met for the SRBS SSCIS.

**5.2.7 Finding for 10 CFR 60.131(b)(10)**

Not applicable.

**5.2.8 Finding for 10 CFR 60.134(a)**

The NRC staff finds that the design of the SRBS to meet the general design criteria for seals has (has not) been acceptably demonstrated and that there is (is not) reasonable assurance that 10 CFR 60.134(a) will be met for the SRBS SSC for the range of scenarios of seal performance for the applicable performance objectives.

**5.2.9 Finding for 10 CFR 60.134(b)**

The NRC staff finds that the selection of seal materials and placement methods has (has not) been acceptably demonstrated and that there is (is not) reasonable assurance that 10 CFR 60.134(b) will be met for the SRBS SSC to reduce, to the extent practical, the potential for creating a preferential pathway for groundwater to contact the waste packages or for radionuclide migration through existing pathways.

**5.2.10 Finding for 10 CFR 60.137**

See Review Plan 4.4.

**5.2.11 Finding for 10 CFR 60.134 for Predicting Long-term Performance of Seals for Shafts, Ramps, and Boreholes**

The NRC staff finds that the evaluation of long-term performance of seals for shafts, ramps, and boreholes has (has not) been acceptably demonstrated and that there is (is not) reasonable assurance that 10 CFR 60.134(a-b): (i) will be met for the methodology for the design of seals, backfill, and drainage systems for shafts, ramps, and boreholes, including the assessment of long-term seal performance and the impact of environmental conditions, repository-generated thermal loads, and repetitive seismic loadings on such performance, to reasonably ensure that they will remain effective during the postclosure period; and (ii) the staff's independent analyses or interpretations of the DOE models or data, as well as those relevant research results conducted by the NRC Office of Regulatory Research regarding design, construction, and performance of seals are consistent with results presented by the DOE.

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